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EDITORIAL

THE END OF THE YEAR

THE publication of this issue of the British Veterinary Journal coincides with the closing of the year. This is a convenient time to look back and to take note of any important happenings. We have written editorial notes on a variety of topics during the year: probably those of most interest and importance, so far as we can judge, dealt with international affairs, including collaboration and the International Veterinary Congress; the other topic of interest concerned the Royal College of Veterinary Surgeons. We make no apology for referring once again to them in this issue.

Veterinarians throughout the world have shown by their individual and co-operative efforts that we are playing an important part in bringing up-to-date, veterinary knowledge in countries in which, unfortunately, during the war period little or no research work could be carried out on problems of animal health and disease; nor was it possible during that period to have the results of research work conveyed to them. The result was that the great progress that had been made in some countries, of which Great Britain is one, was known only in a comparatively few countries. We have been much impressed by the keenness of veterinarians from many parts of the world to obtain information and to acquire new methods and techniques in the diagnosis and control of diseases of livestock, and their eagerness to apply available knowledge and methods to the problems in their own countries. At times we wonder if adequate opportunities are available in any country for the application of the results of research work and of new discoveries. It is agreed generally that our knowledge of causes and methods of combating disease has advanced at a rapid rate; we must arrange that such information is applied to the fullest extent. We feel that there is a good case now to review the position that has been reached in our research work and examine carefully how the results can best be applied in the field, not only in the countries in which the work was carried out but throughout

the world. There is no doubt that much excellent help is being given to-day by a number of organisations in this respect: nevertheless the time seems opportune to concentrate still further on the subject. At the same time further planning of work could be done in order to fill in some of the gaps in our knowledge, which are apparent in most subjects.

Discussion at the recent International Veterinary Congress gave a fair picture of the latest development of some aspects of the problem: it was gratifying to see representatives from so many countries and to find that free discussion of available information, as well as difficulties, took place. The value of such Congresses cannot be overestimated: exchange of views and experiences and the dissemination of scientific facts are all-important. In addition, however, it is very obvious that visits made by workers to other countries are to be encouraged on as extensive a scale as possible. We hope that such visits will be encouraged even to a greater degree than in the past few years: nothing but good to all concerned will be the result. No greater service can be rendered to the livestock aspect of agriculture than a close liaison between veterinarians throughout the world.

The passing of the Veterinary Surgeons' Act (1948) is another milestone in the history of the Veterinary Profession: it will surely come to be regarded as one of the most important events that has taken place. The new Council has been set up in terms of the Act, and the Royal College of Veterinary Surgeons is now proceeding carefully with the fulfilment of the various items provided for in the Act. The Universities concerned with veterinary education are now engaged in the task of arranging for the provision of degrees which will be registrable by the Royal College. We look forward in the not distant future to the smooth running of all the interests provided for in the Act.

We, the Veterinary Profession, have many important responsibilities throughout the world. We accept them, and it is our duty to see that the results of our labours are given every opportunity to bear the rich fruit which can be produced.

We extend to all our readers our best wishes for success in their efforts in the New Year which is about to be born.

XIVth INTERNATIONAL VETERINARY CONGRESS, LONDON, 1949

RESOLUTIONS

The following resolutions were adopted at the closing meeting of the above Congress :—

I. *Swine Influenza.*

" In view of the economic importance and the possible public health significance of the viruses responsible for swine influenza, the XIVth International Veterinary Congress recommends that arrangements be made for viruses isolated in different countries to be sent to selected established centres and examined by the techniques used for strains of human origin by the World Influenza Centre."

The Permanent Committee was begged to forward the resolution to the World Health Organisation, asking to establish a consultative veterinary committee, which could develop the details. The following persons are proposed: Dr. H. W. Schoening, Washington, for the American area; Professor T. Dalling, Weybridge (England), for Europe; Professor Dr. W. I. B. Beveridge, Cambridge, for the Southern Hemisphere.

II. *Tuberculosis.*

" The XIVth International Veterinary Congress learnt with satisfaction that the International Office of Epizootics in Paris has included in its agenda for its next meeting, which is to be held in May, 1950, the question of non-specific reactions during tuberculinisation.

" The XIVth International Veterinary Congress recommends that prophylaxis against animal tuberculosis be included in the agenda for the XVth International Veterinary Congress."

III. *Mastitis.*

" In view of the recent developments which make it possible to curtail radically the economic losses caused by infectious bovine mastitis, and in view of the present shortage of milk and milk products, this Congress recommends that all countries endeavour to carry out efficient control."

IV. *Brucellosis.*

" In view of the seriousness of brucellosis as an economic and public health problem, it is resolved by the XIVth International Veterinary Congress that :—

" (1) Efforts be made by all possible means to eradicate the disease;

" (2) Until eradication by test and slaughter is practicable, vaccination is recommended as a first step and should be correlated with the eradication programme. The vaccine must be produced with the same safeguards as to virulence and immunising properties as the United States Bureau of Animal Industry Strain 19 Vaccine.

" (3) It is further resolved that diagnostic tests and methods be standardised in each country, and that an international standard for the agglutination test be agreed.

" (4) As a public health safeguard pending the eradication of the infection from animals, it is recommended that all milk and milk products be pasteurised.

" (5) It is further considered that international co-ordination and exchange of information are important and should be effected by the appropriate international agencies."

V. *Co-operation by veterinary profession in control of diseases.*

" Whereas many infectious and parasitic diseases of animals, some of which are also communicable to man, may be spread by animal products used for human food; and,

" Whereas the introduction of these diseases into a country reacts against maximum production of food so urgently needed in the world to-day;

" This Congress resolves that veterinary controlling authorities in all countries should be urged to co-operate to the utmost to prevent the spread of these diseases, particularly to those countries in which they do not exist."

VI. *Transportation.*

" The XIVth International Veterinary Congress learns with satisfaction that steps are being taken by certain international organisations to examine questions of transportation of animals, animal products, vegetable products and equipment in so far as they relate to the transmission of infectious diseases of livestock."

VII. *International control of animal diseases.*

" That this XIVth International Veterinary Congress, having directed its attention to the great work which the veterinary profession can do in the control of diseases amongst the milk, meat and egg producing livestock of the world, urges the immediate strengthening of this international organisation so as to set up an active world-wide body capable of advising governments in the urgent steps necessary to control animal diseases.

" The Congress calls upon all national veterinary associations to contribute financially to the development and maintenance of this organisation and asks the Permanent Committee to act vigorously in this matter."

VIII. *Governments co-operation in veterinary education.*

" The XIVth International Veterinary Congress, considering :—

" (1) The importance of veterinary science and practice in the field of production and improvement of domestic animals;

" (2) The advantage for veterinary surgeons particularly concerned with these problems to unite and co-ordinate their efforts, as has been done with success in some countries;

Recommends :—

" (1) That the Government Authorities of each country should place at the disposal of veterinary training and research establishments all necessary facilities to further and promote such activities;

" (2) That in each country consideration should be given to the setting up of a society of veterinarians and that such societies should be set up wherever possible.

IX. *Breeding.*

" In all countries the problems of inefficient breeding and reproduction in domesticated animals are becoming of increasing economic importance by lowering potential production of foodstuffs of animal origin, and it is essential that the basic skill and scientific knowledge of the veterinarian should be more extensively used to improve fertility and to prevent or overcome infertility among farm livestock and thus contribute towards maximum efficiency in animal breeding.

" The XIV International Veterinary Congress, in session in London, August, 1949, is conscious of the urgent need to improve and increase scientific research work and instruction in the physiology and pathology of reproduction in the veterinary schools of all countries, so as to ensure that the members of the veterinary profession will play their full share in the application of increased and new knowledge in solving animal breeding problems.

" To this end it urges the governments of all participating countries to take adequate steps to provide increased facilities for this important work, and to utilise to the maximum extent possible the skill and knowledge of veterinarians, and thus make a greater contribution to the world supply of foodstuffs of animal origin."

X. *Rabies.*

" This Congress urges all governments to take active steps for the world-wide control and eventual eradication of rabies, through the application of the recognised effective measures, namely, veterinary sanitary regulations, quarantine, elimination of stray dogs, the registration and restraint of dogs, and, where necessary, the annual vaccination of all dogs with approved effective vaccine.

" The Congress strongly recommends that international organisations, especially those sponsored by the United Nations, should give active support, and, where necessary, technical assistance to governments for this purpose, and that they should endeavour to keep the issue prominently before the various governments."

XI. *Films.*

" This Congress resolves that the Permanent Committee should elaborate a proposal for the wide distribution of veterinary educational films in all countries and should call upon governments to give adequate grants for the purchase of good talking films recommended by competent veterinary educational authorities."

XII. *Financial support for International Veterinary Congresses.*

"In order that the International Veterinary Congress may be held in all countries, it is resolved that from all participating countries which are represented in the Permanent Committee, a contribution may be made to a Congress fund, from which, if necessary, the expenses of the printing costs of the Congress completely or partly, and those of the Secretariat of the Permanent Committee, may be paid.

"This contribution from each country will be fixed in relation to the number of graduate veterinary surgeons in that country, members of the veterinary organisation.

"The Congress funds shall be administered by the Bureau of the Permanent Committee. The Permanent Committee proposes now that the contribution should be fixed at 1s., or its equivalent of that per year, for each veterinary surgeon in each country."

XIII. (*re new version of paragraph 7 of the Bye-Laws*):—

"In each country a permanent National Committee should be established, which, in constant co-operation with the Organising Committee of the country in question, will carry out the tasks mentioned in this paragraph.

"Ways and means of starting this National Committee will be left to the Veterinary Association of the country concerned.

"The National Committee, once established, will, however, supplement itself from time to time and report its constitution to the Secretary of the Permanent Committee. The representative of a country in the Permanent International Committee will be proposed by the National Committee of that country.

"The Chairman of the National Permanent Committee and the representative of that country in the Permanent International Committee should, if possible, be one and the same person."

(That is to say, a member in the Permanent Committee representing a country will be the chairman of the Permanent National Committee.)

"The duty of National Committees shall be to undertake the work of propaganda for the Congress, to enrol members, to obtain subscriptions and to forward them to the Organising Committee, and to supply information as to the office, rank and status of individual members of the Congress, especially of the official representatives of authorities, corporations, etc."

XIV (*re new version of paragraph 6 of the Statutes*):—

". . . the members of the different countries being chosen on the proposal of the Permanent National Committees of the countries concerned and shall be nominated by the chief meeting of the Congress by unanimous assent of majority of votes."

GENERAL ARTICLES

THE RECTAL TEMPERATURE IN NORMAL AND INFECTED PIGS

By E. MURRAY PULLAR, M.V.Sc.,
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In man and some of the domesticated animals the body temperature is a useful indicator of abnormality and the progress of infection. The pig, on the other hand, appears to have a less efficient thermo-regulatory mechanism, as the temperature varies over a considerable range.

In the available literature there is no unanimity regarding the possible range of temperature. The figures published by the various authors are (temperatures in degrees Fahrenheit): Hobday (1896), also quoted by Smith (1921), *adults* 100.0-102.0, *young pigs* 101.5-103.5; Malkmus (1923), 100.4-104.0; Woolridge (1923), *adults* 101.0-102.0, *young pigs* 102.0-104.0; Banham and Young (1935), 101.2-104.0; Dukes (1937), 101.6-103.6; and Lamont (1938), 101.0-103.5.

Object of Investigation

The object of this investigation was to determine (for the individual pig, as well as the species in general) the extent of the normal range, the mean temperature, the variation about the mean, and to devise a method of assessing the significance of any rise above the normal level.

Recording Rectal Temperatures

Clinical thermometers. As a general rule, standard clinical thermometers were used throughout the investigation. The thermometers on the Melbourne market are of English manufacture and are of the type known as " half-minute." They are approximately 10 cm. long, of which the bulb occupies about 1.5 cm. and the graduated scale 5.0 to 5.5 cm. They are marked according to the Fahrenheit scale from 95 to 110 degrees in units of 0.2 degree. As the distance between the markings is approximately 0.7 mm., and they are only guaranteed as accurate to plus or minus 0.2 degrees, they were read to the nearest 0.2 degree.

With one exception, all records and calculations were made in the Fahrenheit scale, and the final results shown in that scale with their equivalent in Centigrade.

The pigs were housed in small pens or sties, and were secured and restrained by driving them into a corner and pressing them against the wall with a knee. If necessary, additional restraint was effected by holding an ear or the tail.

The thermometer was lubricated with water and inserted into the rectum for at least two-thirds its length, and kept in position for approximately one minute.

Age of experimental animals. The pigs were of various ages from two to eight months, the majority being under five months. As no adult pigs were included in the series, it was not possible to study the effect of age on normal temperature.

Accuracy of observations. The clinical thermometers could be assumed to be reasonably accurate. They are usually sold with a certificate that they have been individually tested and are accurate to within plus or minus 0.2 degrees F.

The error due to parallax in measuring the height of the column of mercury was very small, and could be disregarded.

Factors Affecting Rectal Temperature

It has been well established for other species that the body temperature varies slightly from organ to organ, and that the temperature of the rectum is proportional to that observed elsewhere. Although these observations have not been repeated with pigs, it is assumed that they also apply to that animal.

Relatively low temperatures are observed when there is some degree of ventilation of the rectum, probably due to the lack of tone of the sphincter ani. When the temperature is found to be subnormal it should be checked ten to twenty minutes later.

Subnormal temperatures were observed more frequently in some pigs than others, and were often noted in those with infectious pneumonia. Subnormal temperatures were rarely noted in animals with enteric infections.

Temperature Gradient

Kriss (1921), and others, have shown that there is a definite temperature gradient in the rectum, and that in the case of the cow the maximum temperature zone is about 6 to 7 inches (15-18 cm.) from the sphincter ani.

In this investigation the temperature gradient was measured in three normal pigs about five months old, by the following method:—

(1) The animal was restrained by placing it in a narrow wooden crate, with the side cut away to facilitate observation. In addition, one rope was passed under the abdomen, just in front of the pelvis, and another round one thigh.

While it was realised that this would produce some degree of excitement pyrexia, it was considered that this would only exaggerate, but not alter, the position of the temperature gradient.

(2) The thermometer used was a standard instrument graduated according to the Centigrade scale, and could be read to 0.1 degree C. This type, with a freely moving column, was used in preference to a clinical thermometer, in which the mercury is trapped in the maximum position, as the readings at the various depths could be made without the necessity of withdrawing it and shaking down the column between readings.

(3) The temperature was taken at the following positions, measured from the sphincter ani to the stem end of the bulb: 1, $2\frac{1}{2}$, 5, $7\frac{1}{2}$, 10 and 15 cm. (= approx. $\frac{1}{2}$, 1, 2, 3, 4 and 6 inches).

(4) The temperature was taken at each position as the instrument was passed forward, and again as it was withdrawn, and the average of the two readings in each position calculated. Actually, there was little or no difference between the first and second readings.

(5) The measurements were made on each pig on two separate days.

The results (Fig. 1) show that in the three pigs examined there was a definite and almost identical temperature gradient in the rectum.

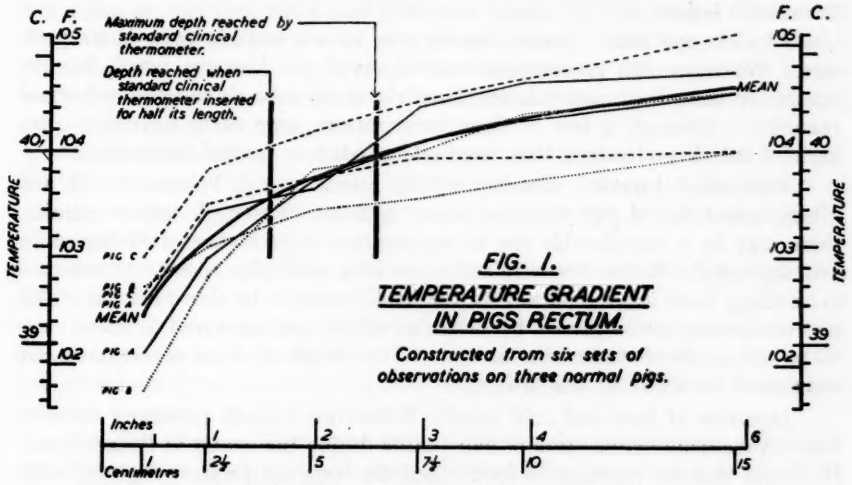

FIG. 1.
TEMPERATURE GRADIENT IN PIGS RECTUM.
Constructed from six sets of observations on three normal pigs.

As the temperature gradient was still rising, the maximum temperature zone probably lies at a greater depth than 15 cm. (6 in.).

The maximum temperature zone lies beyond the greatest depth that can be reached by a standard clinical thermometer (6½ cm., or 2½ in.).

It would not be practicable to employ a longer instrument for routine use, as in one pig some difficulty was experienced in reaching 10 cm., and in all three there was considerable difficulty in passing the instrument to 15 cm. (6 in.)

From the limited data gathered, it appears that most pigs have a similar temperature gradient, and, provided the clinical thermometer is inserted to its maximum depth, the error due to this cause will be small (approximately 0.6 degree F., or 0.35 degree C.).

Factors Affecting Body Temperature

Temperature of environment. As in other animals, the body temperature of the pig rises if the temperature of the environment is high. Palmer (1917) has shown that on a hot day the rectal temperature may be as high as 108 degrees F.

Robinson and Lee (1941) studied the effect on the pig of hot atmospheres at different levels of humidity. The experiments were conducted in rooms in which the environmental conditions could be controlled. They observed a similar rise in body temperature when the air was hot, particularly when it was accompanied by high humidity.

This phenomenon was noted in the present series, although no experiments were conducted to investigate that aspect of the subject. To ensure that only normal temperatures were recorded, observations during the summer months

were made either early in the day, before the animal could bask in the sun, or late in the afternoon, when the atmospheric temperature was falling.

No known cases of hot environment pyrexia were included in the "normal" series.

Physiological state. Sows in œstrus may show a small increase in temperature. Whenever this phenomenon was observed the fact was noted, but the number of recognised cases was small, as few of the animals had reached sexual maturity. Although a few of these temperatures were at or near the upper limit of the normal range, they were all included as normal temperatures.

Excitement pyrexia. Hobday (1896), Lynch (1914), Palmer (1917), and others, noted that if pigs run even short distances, or struggle under restraint, there may be a considerable rise in temperature to as high as 106 degrees or 107 degrees F. It was noted in this series that until pigs become accustomed to handling there was a tendency for the temperature to be above normal. This was not always accompanied by muscular effort, and appeared in some cases to be the result of excitement or fear. The details of these observations are elaborated elsewhere in this article.

Ingestion of food and cold water. Kriss (1921) made a series of observations on the body temperature of dairy cattle during the winter in Pennsylvania. He found that the ingestion of food raised the body temperature slightly, while cold water caused a fall, which was proportional to the quantity drunk. It was not possible to study this phenomenon in relation to pigs in this investigation.

Infection. The thermic response to infection is well known, and was studied in detail.

Available Data

Over the last twenty years a large number of pigs has been under observation at this Institute, and 353 temperature charts were available for study. Some of these showed febrile reactions in experimental animals and natural cases of infection, while others were from normal pigs under observation preparatory to inclusion in experiments, animals in which no temperature reaction was observed, and a few which recovered from experimental exposure to infection and were kept under observation for long periods to ensure that there was no delayed reaction.

Normal pigs. The available records were examined, and 88 charts were selected for detailed study. In 63 of these the entire period could be regarded as normal. The number of days under observation varied from 4 to 140 (mean 34.5). In the other 25, only part of the recorded period could be regarded as normal. In these cases the number of days under observation varied from 16 to 141 (mean 50).

Infected pigs. Charts for 62 infected pigs were later used to test the suggested method (*vide* "Method of Analysis," paragraphs 13 and 16).

Method of Analysis

The following is a description of the method of analysis. The results obtained are described later under the appropriate headings:—

(1) For convenience, the normal temperatures recorded on the graphs were transferred to "work sheets." These consisted of single foolscap sheets ($13\frac{1}{2}$ x $8\frac{1}{2}$ inches) divided in two by a line down the middle. The left half had five columns; the first, third and fifth were blank. In the second column the Fahrenheit scale was set out in units of 0.2 degree. The figures in column four were the squares of the numbers in column two. The right half of the work sheet was set out with spaces for notes, calculations and recording extracted data (mean, standard error, etc.).

The number of times each temperature was observed was inserted in the middle column. The sum of the observations and the sum of the squares of the observations were calculated by means of columns one and five, respectively, after multiplying across.

(2) The total of all observations on normal pigs was calculated by combining the work sheets.

As the pigs comprising this series had been obtained from several sources, separate extractions were made at this stage and the results compared. As the variation from group to group was small and not significant, they were combined to form one series in all subsequent steps.

(3) The mean and standard error of the combined series was calculated, and the records of all pigs with temperatures falling beyond the range mean, plus or minus three times the standard error, were subjected to a further scrutiny and the complete records of several animals rejected, as there was some doubt regarding their normality.

(4) The mean temperature for each individual pig was then calculated.

(5) To exclude "excitement pyrexia," all initial temperatures were re-examined, particularly those in which any temperature in the first week was above the level of the mean for the pig plus three times the standard error for all pigs combined. In ten pigs the initial temperatures for the first few (maximum four) consecutive days were excluded, as they showed marked

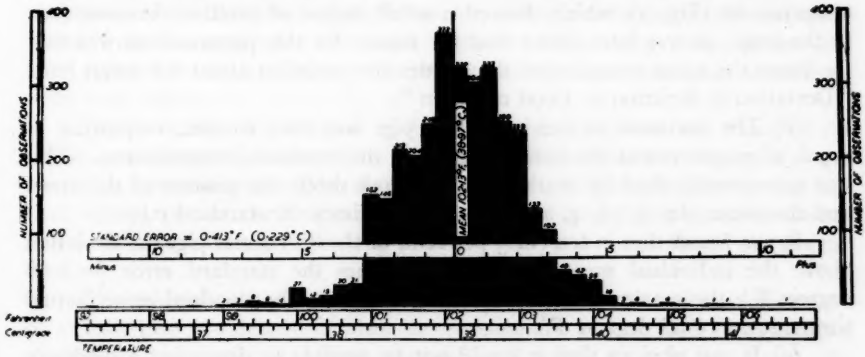

FIG. 2.

HISTOGRAM SHOWING THE RANGE AND VARIATION IN THE RECTAL TEMPERATURE OF NORMAL PIGS

CONSTRUCTED FROM 3304 OBSERVATIONS ON 88 PIGS.

evidence of excitement pyrexia, and where applicable the individual means were recalculated.

Note. The figures for the total number of normal pigs in the series shown under " Available Data " are those which applied after the adjustments in steps (3) and (5) were made.

(6) After this final adjustment, the mean, standard deviation and standard error for the combined normal temperatures were recalculated. (Fig. 2.)

(7) The means for the individual pigs were compared by constructing an

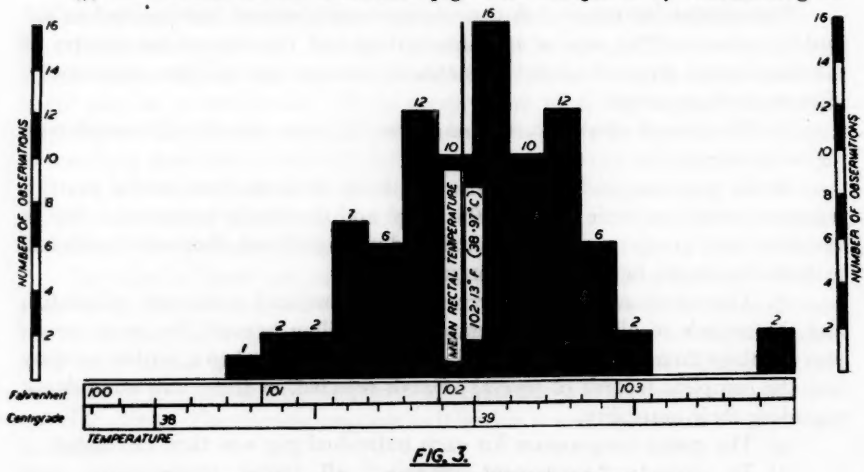

FIG. 3.

HISTOGRAM SHOWING THE RANGE AND VARIATION IN THE MEAN RECTAL TEMPERATURE OF 88 NORMAL PIGS

histogram (Fig. 3). It was noted that there was a small degree of negative skewness (i.e., to the right), in contrast to the scatter of the combined normal temperatures (Fig. 2), which showed a small degree of positive skewness (i.e., to the left). It was later found that the reason for this phenomenon was that the lower the mean temperature the greater the variation about the mean (*vide* " Deviation in Relation to Level of Mean ").

(8) The variation in the individual pigs was then studied, employing as a unit of measurement the standard error of the combined temperatures. This was conveniently done by marking on the work sheets the position of the mean and the mean plus 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, 6, 7 and 8 times the standard error.

It was found that in ten (11.5 per cent) of the 88 normal pigs the deviation above the individual means exceeded $4\frac{1}{2}$ times the standard error (= 1.86 degrees F.), the maximum deviation being 8.0 times the standard error (actual temperature 105.6 degrees F.).

(9) It was obvious that it would not be possible to determine a workable upper limit to the normal range which would ensure that all temperatures below the selected level were normal and all above it significantly elevated. Therefore it was decided to adopt a standard which in the combined totals would include

the majority of observations (over 99 per cent), but which would not exclude the occasional short but normal periods of elevated temperatures, such as that shown by Pig No. 54 (Fig. 10).

As the majority of pigs used in transmission experiments are kept under observation for about three to four weeks, it was resolved that the level selected should ensure that not more than one in twenty-five normal observations should be above the critical level.

A study of the available data indicated that it could also be laid down that to be accepted as normal these periods of elevated temperature (i.e., temperatures above or near the critical level) should extend over less than 24 hours.

(10) In this series of normal pigs, in every case, except one, the critical level could be the mean plus 4½ times the standard error, and still satisfy these additional requirements. The single exception was one in which there was a rise which lasted 48 hours, the two temperatures being 103.2 degrees and 103.4 degrees F., which were 4.25 and 4.75 times the standard error above the mean. It should be noted that although this pig appeared to be normal, it was not possible to guarantee that this was not a reaction to some sporadic infection. In addition, this was probably an extreme case, as the mean temperature was the eighth lowest in this series (101.44 degrees F.).

(11) As it is obviously impossible to obtain a life-time record of temperature for each pig, the mean must of necessity be calculated from a sample of the whole. Although it is well known that the larger the sample the smaller the difference between the calculated mean and the actual mean, there is a limit to the number of pre-exposure observations which can be made under normal laboratory or field conditions. It would be desirable to have about 21 or more normal observations, but it is seldom possible to hold experimental pigs for more than a week preparatory to inclusion in experiments.

To test the reliability of seven daily observations as a basis for calculation, the means of the first seven observations for each pig were calculated and compared with the means for the whole period. Where any temperatures had been rejected on account of excitement pyrexia, the first seven normal observations were taken.

The deviation of the mean of the sample of seven from the mean of the whole period varied from minus 0.5 degree F. to plus 1.0 degree F., and showed an even scatter. The reason for this bias is probably due to the fact that some degree of excitement pyrexia persists for several days, and the means calculated from the first seven-day period would tend to be above the normal level.

This calculation showed that it would be necessary to make an allowance of at least plus 0.5 degree F. when determining the critical level from a mean established from only seven observations. Possible ways of increasing the number of pre-exposure observations are discussed elsewhere in this article.

(12) A suggested method of testing rises in temperature for significance based on these observations was then formulated (*vide* Appendix "A"), and was tested on all records in which it was possible to calculate the mean.

For convenience, the constant added to the mean was reduced to 1.8 degrees F. (1.0 degree C.) from $4\frac{1}{2}$ times the standard error (= 1.86 degrees F.).

(13) From the available collection of charts, 45 were selected to test the suggested method against the reactions of infected pigs. The charts employed were those in which there was some apparent rise in temperature, however slight, following exposure to infection, and a sufficiently long normal period to establish a mean.

(14) The records for the normal periods were transferred to work sheets and the means calculated.

(15) The observations made during the periods of possible thermic reaction were transferred to a second series of work sheets, and the position of the mean and multiples of the standard error were marked, and the deviation from the mean studied, as in (8) above.

(16) A further series of 17 charts from pigs used in research on swine dysentery, made available by C. J. R. Gorrie, B.V.Sc., of this Institute, were treated similarly.

(17) The results were very encouraging where more than twenty-one observations were available to establish the mean. This method appears to give an accurate interpretation of the results, with very few doubtful or borderline cases. Where the mean had to be calculated from a smaller sample the results were less reliable, and there was a marked increase in the proportion of doubtful and borderline cases.

NORMAL PIGS

Combined Observations (Fig 2)

Mean, 102.13 ± 0.413 degrees F. (38.97 ± 0.299 degrees C.). Standard deviation, 23.47 and 13.04, respectively. The coefficient of variation was 23.0,

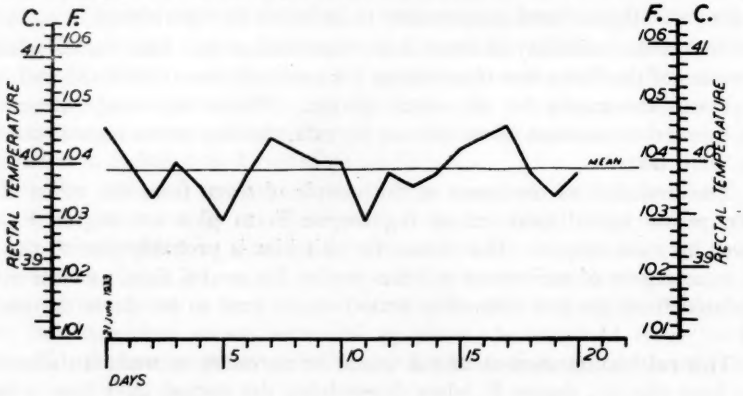

FIG. 4.

RECTAL TEMPERATURE OF PIG. No. 48.

ONE OF TWO NORMAL PIGS THAT MAINTAINED A CONSISTENTLY HIGH TEMPERATURE. MEAN. 103·88°F. (39·93°C.)

and there was only a slight degree of positive skewness (i.e., to the left) in the distribution about the mean. The range was 97.2 degrees F. to 106.6 degrees F. (36.2 degrees C. to 41.4 degrees C.).

Individual Pigs

The individual means (Fig. 3) varied from 100.99 degrees F. to 103.89 degrees F. (38.33 degrees C. to 39.94 degrees C.), and they were not scattered evenly about the mean, but showed some degree of negative skewness (i.e., to the right).

The two pigs with the very high mean temperatures appeared to be normal animals in that their temperatures, although high, did not fluctuate greatly from day to day (Fig. 4), and they never exhibited any signs of infection and no lesions were found at autopsy.

Deviation from the mean. In 62 pigs (70 per cent) the maximum temperature recorded was less than 1.24 degrees F. above the mean. In 14 (16 per cent) the maximum temperature recorded was over 1.65 degrees F. above the mean, and in 5 (5.5 per cent) it was over 2.06 degrees F. These levels correspond to 3, 4 and 5 times the standard error, respectively.

Only 5 (0.15 per cent) of the observations lay above the range—mean plus 1.8 degrees F. (1.0 degree C.).

The maximum deviation above the mean was 8.0 times the standard error (actual temperature 105.6 degrees F.) (Fig. 5.).

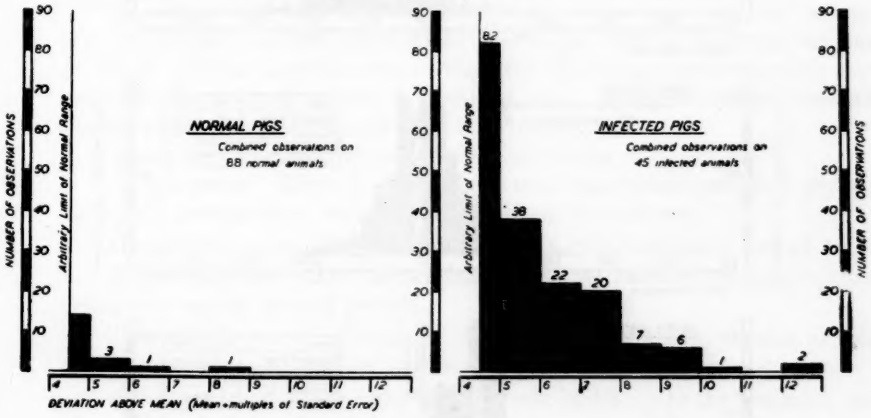

FIG. 5.

HISTOGRAMS SHOWING RANGE AND VARIATION OF VERY HIGH RECTAL TEMPERATURES IN NORMAL AND INFECTED PIGS

DEVIATION ABOVE MEAN EXPRESSED IN MULTIPLES OF THE STANDARD ERROR OF ALL OBSERVATIONS ON NORMAL PIGS = 0·413°F (0·229°C)

In 45 pigs (51 per cent) the lowest temperature recorded was less than 1.24 degrees F. below the mean. In 19 (22 per cent) the lowest recorded temperature was over 1.65 degrees F. below the mean, and in 11 (12.5 per

cent) it was over 2.06 degrees F. These levels correspond with 3, 4, and 5 times the standard error, respectively.

Deviation in relation to the level of the mean. (Fig. 6.) When it was noted that the distribution of the combined observations about the mean did not conform to the same pattern as the distribution of the individual means, steps were taken to determine the deviation in relation to the level of the mean.

The work sheets were arranged in order of descending magnitude of the means and divided into five approximately equal groups, the first, third and fifth corresponding to " high means," " medium means " and " low means."

The observations in these three groups were then combined, and each group extracted separately. The means for these three groups were: 102.92 degrees F., 102.26 degrees F., and 101.46 degrees F. The standard errors were 0.82, 0.89 and 0.99, and the coefficients of variation 19.91, 22.64 and 25.78, respectively. Thus the variation in the " low mean " group was 1.3 times that in the " high mean " group, and was statistically significant. In other words, the lower the mean temperature the greater the variation about the mean.

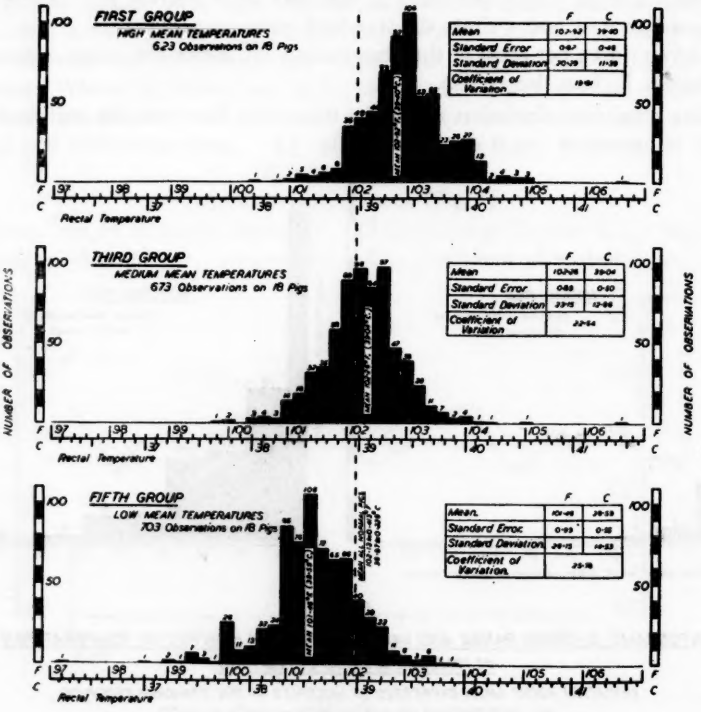

FIG. 6.

HISTOGRAMS SHOWING THE DEVIATION FROM THE MEAN IN RELATION TO THE LEVEL OF THE MEAN.

CONSTRUCTED FROM 1999 OBSERVATIONS ON 54 NORMAL PIGS.

As the range of this variation is still within the arbitrary normal limits, there is no necessity to adjust the method of testing according to the level of the mean.

Subnormal temperatures. As subnormal temperatures are probably of little or no value for the diagnosis of disease, they were not studied in any great detail.

If it is assumed that the limit of normal range below the mean is the same as that above (viz., 1.8 degrees F.), 15 (17 per cent) of the pigs showed subnormal temperatures. Of these, in eight cases there was only one single low figure recorded. The remaining seven cases showed subnormal temperatures on a number of occasions, the most frequent recurrences being: three times in 26 days, three times in 46 days, four times in 62 days, and three times in 92 days.

Although these pigs appeared to be in perfect health, there may have been some abnormality. They were all under experiment during the first year, and it is highly probable that the technique to avoid cases of rectal ventilation was not strictly observed. On the other hand, at that time the pigs were housed in unsuitable pens, with very little room for exercise and no access to direct sunlight, and many ultimately developed rickets. Under these unsatisfactory conditions it is possible that there may have been some lack of muscle tone of the sphincter ani.

INFECTED PIGS

Types of Fever

According to Beattie and Dickson (1943), fevers may last for varying periods, and can usually be divided into three stages, viz., the *onset,* the *fastigium* or *height,* and the *defervescence.* When the third stage (defervescence) starts suddenly, and proceeds rapidly, it is termed *crisis.* When the temperature falls slowly, possibly with occasional rises, it is termed *lysis.*

Fevers may conveniently be classified as follows:—

Simple fevers. There is usually only one well-marked period of pyrexia, lasting for several days, and followed by death or recovery.

Continuous fevers. Pyrexia continues for a relatively longer period.

Remittent fevers. The fever waxes and wanes at short intervals, without definite or regular normal periods.

Intermittent fevers. Periods of pyrexia alternating with normal periods, usually according to a definite and regular pattern, as in malaria.

Relapsing fevers. The temperature slowly builds up to the fastigium, and after a crisis it immediately commences to rise again. This cycle is repeated a number of times.

Undulant fevers. Long periods of almost continuous pyrexia are separated by periods of less intense pyrexia, both phases being of irregular duration.

Of the 62 charts from infected pigs used in this investigation, in 17 the rises shown were regarded as not significant. Of the remainder, the numbers of the various types of febrile reactions were: simple fevers 23, continuous fevers 20, and remittent fevers 2.

It is obvious that the method must be tested against a larger number of cases, particularly those showing types of febrile reactions not included in the present series.

Deviation from the Mean

In the case of the infected pigs, the maximum deviation from the mean was 12.9 times the standard error (actual temperature 106.6 degrees F.) (Fig. 5).

It should be noted that in the case of the infected pigs the deviation from the mean was usually considerably greater than with normal pigs, although the latter included temperatures well above the normal range.

EXCITEMENT PYREXIA

(Figs. 7 and 10.)

In the records of 57 pigs the daily observations for the first six days were complete, and were available for comparison with the remainder of the period.

In 10 (18 per cent) excitement pyrexia was sufficiently marked to justify rejection of some of the observations from the normal series. In four cases this marked reaction persisted for one day, in three cases for two days, in two cases for three days, and in one case for four days.

Histograms depicting the distribution of the temperatures during the first six days (Fig. 8) show that there was an increase in the proportion of high temperatures. This was very marked on the first and second days, and still persisted on the sixth day.

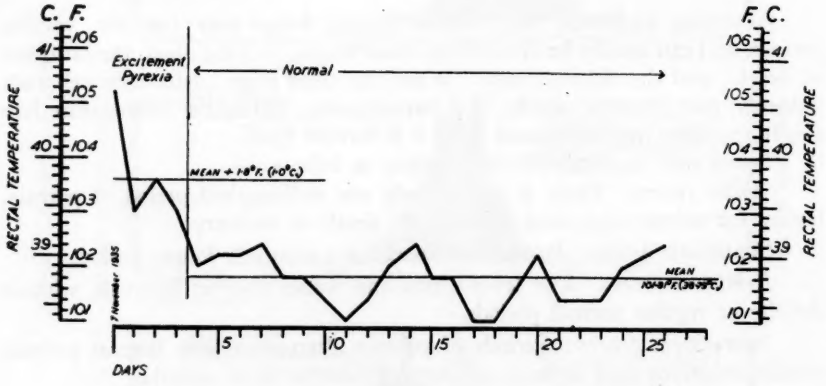

FIG. 7.

RECTAL TEMPERATURE OF PIG No. 109.

SHOWING EXCITEMENT PYREXIA FOR THE FIRST FOUR DAYS.

The means for the first six days were: Fahrenheit scale, 102.78, 102.54, 102.41, 102.49, 102.38 and 102.45. Centigrade scale, 39.32, 39.18, 39.12, 39.16, 39.10 and 39.13. These were all above the mean for normal pigs, viz., 102.13 degrees F. (38.97 degrees C.).

The exact cause of excitement pyrexia is not fully understood. In some

cases there may have been some struggling, but in others the pigs soon became quiet under restraint, and although the skeletal muscles were often taut, there were no violent movements. It is assumed that excitement and fear were largely responsible for these reactions, possibly by stimulating the liberation of adrenalin.

INCREASING THE NUMBER OF PRE-EXPOSURE OBSERVATIONS

As noted under "Method of Analysis," the number of pre-exposure observations should be as large as possible, and preferably more than 21. As

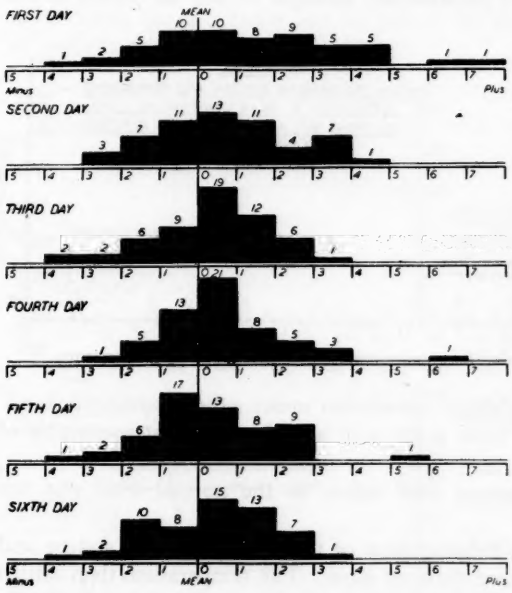

FIG. 8.

EFFECT OF EXCITEMENT PYREXIA ON INITIAL OBSERVATIONS.

HISTOGRAMS CONSTRUCTED FROM COMBINED DAILY RECORDINGS OF RECTAL TEMPERATURES OF 57 NORMAL PIGS.

SHOWING DEVIATION FROM MEAN EXPRESSED IN MULTIPLES OF THE STANDARD ERROR OF ALL OBSERVATIONS ON NORMAL PIGS. = 0·413°F (0·229°C.)

it is seldom possible to hold pigs for three weeks prior to experiment, it is necessary to adopt some alternative to the usual daily recording. In this investigation it was possible in many instances to increase the number of recordings by combining those taken during the incubation period with those taken after signs of infection had disappeared. This practice is unreliable, and is only applicable in comparatively few cases.

The possibility of increasing the number of observations in a limited period by taking two or more recordings each day was investigated.

In a limited series (six pigs) the night and morning rectal temperatures were taken for 17 to 27 consecutive week-days. The mean morning temperatures were: Fahrenheit scale, 100.99, 102.0, 102.41, 102.45, 102.82 and 102.87. The differences between these and the corresponding mean evening temperatures were: minus 0.55, plus 0.18, plus 0.01, plus 0.14, plus 0.06 and plus 0.01. None of these differences were statistically significant. In only 13 (9.5 per cent) of the 136 pairs of observations was the difference between the morning and evening temperatures greater than 0.4 degree F. (0.22 degree C.).

These results indicate that there is little, if any, diurnal variation in the pig's temperature, and that there is no apparent objection to increasing the number of pre-exposure observations by taking two or more recordings each day. It would be advisable to check this observation over a greater series of animals.

PERMANENT ALTERATION IN THE MEAN TEMPERATURE LEVEL

One pig, not included in any of the above series, is of interest, as the mean temperature level suddenly and permanently changed during the period it was under experiment (Fig. 9).

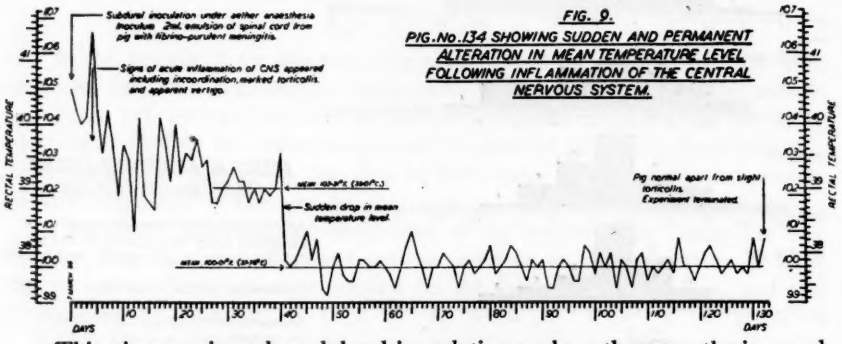
Subdural inoculation under aether anaesthesia
Inoculum 2ml. emulsion of spinal cord from pig with fibrino-purulent meningitis.
Signs of acute inflammation of CNS appeared including incoordination, marked torticollis and apparent vertigo.
Sudden drop in mean temperature level
Pig normal apart from slight torticollis. Experiment terminated.
RECTAL TEMPERATURE
DAYS

FIG. 9.

PIG. No. 134 SHOWING SUDDEN AND PERMANENT ALTERATION IN MEAN TEMPERATURE LEVEL FOLLOWING INFLAMMATION OF THE CENTRAL NERVOUS SYSTEM.

This pig was given, by subdural inoculation under æther anæsthesia, 2 ml. of an emulsion of spinal cord from a pig with a fibrino-purulent meningitis of unknown ætiology.

No pre-exposure temperatures were taken, so the normal level was not known.

This pig showed signs of inflammation of the central nervous system and almost continuous fever for more than 20 days. The temperature then settled down to what appeared to be normal levels, and, apart from marked torticollis and occasional attacks of what appeared to be vertigo, the pig showed few signs of infection.

On the 40th day the temperature suddenly fell several degrees from a mean of about 102.2 degrees F. (39.0 degrees C.), and remained reasonably constant at the low mean temperature level of 100.01 degrees F. (37.78 degrees C.) for the remaining 92 days of the experiment. During that time the torticollis improved considerably and the attacks of vertigo ceased entirely.

According to Beattie (1936), and Beattie and Dickson (1943), the organs involved, and their rôle in the physiology of thermoregulation, are not fully known, but include the central and the sympathetic nervous systems. The latter appears to act either directly or through the ductless glands, particularly the suprarenal and possibly the thyroid.

In this pig the inflammatory reaction in the central nervous system probably upset or destroyed the thermoregulatory mechanism in that region, and the body temperature was later stabilised at a lower level by the peripheral centres.

Appendix "A"

SUGGESTED RULES FOR TESTING THE SIGNIFICANCE OF APPARENT PYREXIA

(Fig. 10.)

General

(1) Pyrexia apparently due to fear or the muscular effort of struggling is shown by many pigs during the first few days of observation, therefore no reliance can be placed on a single recording from an individual animal. On the other hand, great reliance can be placed on the reaction shown over a series of well-organised observations.

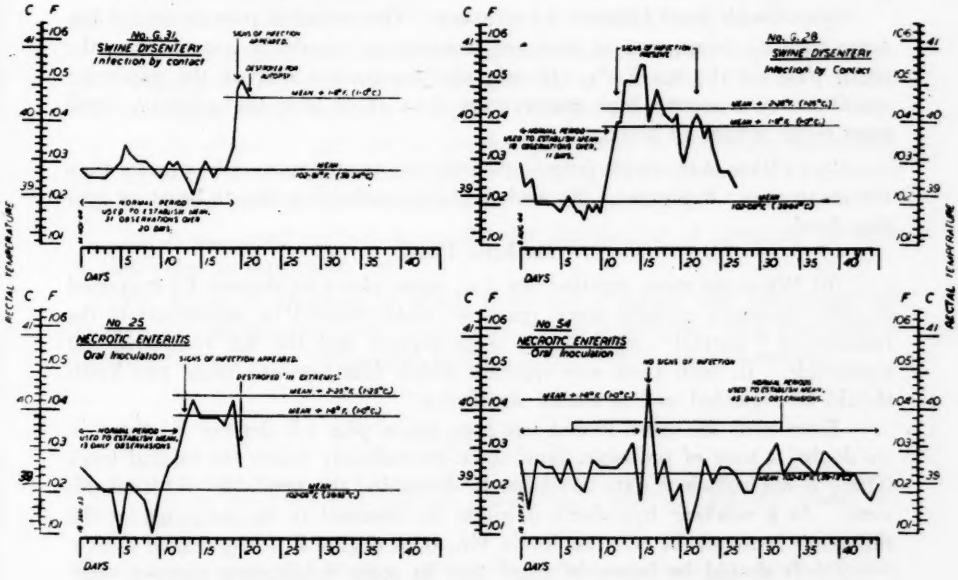

FIG. 10. SHOWING METHOD OF TESTING THE SIGNIFICANCE OF APPARENT PYREXIAS *Vide* Appendix A

No. G. 31. Simple Fever. Over 21 normal observations. Significant rise.
No. G. 28. Continuous Fever and Recovery. Less than 21 normal observations. Significant rise. (Note—excitement pyrexia over first three observations.)
No. 25. Continuous Fever and Death. Less than 21 normal observations. Rise probably significant. This case illustrates the necessity for an adequate number of normal observations to establish the mean.
No. 54. Rise not significant (duration too short.) Similar isolated high temperatures were shown by 5·5 per cent of all normal pigs.

(2) All observations should be made, as far as possible, under stabilised and identical conditions. The pigs should be secured and restrained with the minimum of disturbance, and the thermometer should be inserted to the maximum depth.

Establishment of the Arithmetic Mean or Average

(3a) *When initial temperatures are not obviously outside the normal range.* The mean should be calculated from not less than seven pre-exposure observations. More reliable results will be obtained if the number of normal observations can be increased to 21, as this will not quite double the accuracy of the

calculation of the mean. Some methods of increasing the number of observations without extending the pre-exposure time are discussed elsewhere.

(3b) *When the initial temperatures are obviously outside the normal range.* The first few (one to three, or more) elevated temperatures should be discarded and the pre-exposure period extended to include not less than seven, but preferably 21 or more, consecutive observations within the normal range.

Interpretation of Results

(4) The period of pyrexia should occur under circumstances where it can reasonably be supposed to be a reaction to the conditions of the experiment.

(5a) *Simple fever, followed by death.* A least one observed temperature should be greater than the mean plus 1.8 degrees F.(*)

(5b) *Simple fever followed by recovery.* The period of pyrexia should last more than 24 hours, and at least one temperature should be greater than the mean plus 1.8 degrees F.(*). If only one observation reaches the minimum qualification, a second high temperature (i.e., at or near the arbitrary level) must occur within 48 hours.

(5c) *Other than simple fevers.* At least one temperature to be greater than the mean plus 1.8 degrees F.(*), and the other peak, or peaks, to be at or near that level.

Doubtful Cases

(6) When the more exacting test (i.e., mean plus 2.25 degrees F.) is applied it will naturally exclude some reactions which should be significant if the number of "normal" observations were greater and the less restrictive test applicable. In such cases any reaction which falls between these two limits should be regarded as "probably significant."

Even with the more liberal test (i.e., mean plus 1.8 degrees F.) there is, no doubt, a zone of probable significance immediately below the critical level. There is not sufficient data available to determine the probable width of this zone. As a working hypothesis it might be assumed to be the same as the difference between the two test levels, viz., 0.45 degree F. (0.25 degree C.).

(7) It should be borne in mind that in some debilitating diseases there may be some slight degree of ventilation of the rectum, due to reduction in muscular tone. While this might not be sufficient to produce a subnormal temperature, it might lower the rectal temperature during a fever sufficiently far to bring it below the critical level. This appears to be a frequent phenomenon in cases of swine dysentery.

SUMMARY

(1) The object of this investigation was to determine (for the individual pig, as well as the species in general) the extent of the normal range, the mean temperature, the variation about the mean, and to devise a method of assessing the significance of any rise above the normal level.

(*) This constant applies where the mean has been established from 21 or more observations. When the mean has been calculated from a smaller series (not less than seven) the test level should be the mean plus 2.25 degrees F. (Note: 1.8 degrees F. = 1.0 degree C., and 2.25 degrees F. = 1.25 degrees C.)

(2) From a study of the records of 88 normal pigs it was found that the mean rectal temperature was 102.13 ± 0.413 degrees F. (38.97 ± 0.229 degrees C.), the range being 97.2 degrees F. to 106.6 degrees F. (36.2 degrees C. to 41.4 degrees C.).

(3) It was found that in the individual pigs the lower the mean temperature the greater the variation about the mean.

(4) Only five (0.15 per cent) of the observations on normal pigs lay above the level of the mean for that individual pig plus 1.8 degrees F. (1.0 degree C.), i.e., approximately $4\frac{1}{2}$ times the standard error for all observations.

(5) There is a marked temperature gradient in the pig's rectum, and the maximum temperature zone appears to be more than 6 inches (15 cm.) from the sphincter ani and beyond the reach of the standard clinical thermometer.

(6) If the clinical thermometer is inserted to its maximum depth the difference between the recorded temperature and that at a depth of 6 inches (15 cm.) will be approximately minus 0.6 degree F. (minus 0.35 degree C.).

(7) In about 18 per cent of normal pigs there is a definite excitement pyrexia until they become accustomed to handling. For this reason no reliance can be placed on a single observation on an individual pig.

(8) A suggested method for testing the significance of apparent pyrexias is elaborated in Appendix "A."

(9) A case is described in which there was a sudden and permanent fall in the mean temperature level, apparently due to interference with that part of the thermo-regulatory mechanism located in the central nervous system.

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SHORT WAVE THERAPY IN VETERINARY PRACTICE

By BRIAN DENNY,
Haslemere.

SHORT wave therapy has been used with great success by the medical profession for many years, but no serious attempt appears to have been made to introduce it into veterinary work until the writer commenced a series of experiments in the treatment of tendon and ligament strain in the horse in November, 1948.

In view of the success which attended these experiments, and a number of subsequent treatments, this article has been written with a view to stimulating the interest of the veterinary profession in this therapeutic aid.

Short wave therapy is treatment through the medium of radio frequency electric currents such as are more popularly known to provide a means of communication or entertainment. They are the currents which give rise to the "wireless waves" carrying the programmes from the transmitters of the B.B.C. to the radio receivers in our homes. The apparatus used is in many respects similar to a low power radio transmittter in which the energy generated is conducted to the tissues under treatment, instead of being fed into an aerial to be radiated over the world.

Many readers will be acquainted with electricity only in so far as it supplies light and power to the home, is conducted there by cables from some distant power station, and may be made to function by the pressure of a switch. Many will have heard of "d.c." and "a.c." as being two forms of supply, and a few will know the meanings of these abbreviations. Before the currents used in short wave therapy can be understood it is necessary that the difference between these two forms should be appreciated.

Strict accuracy of description will not be attempted here, but it is hoped by analogous illustration to convey some idea of the nature of electric currents.

The abbreviations "a.c." and "d.c." refer to alternating current and direct current, respectively, the adjectives referring in each case to the flow of the current. Direct current flows continuously and is uni-directional, while alternating current is constantly changing its direction of flow, and, consequently, its magnitude.

An electric current is electricity in motion, or, to put it more correctly, a movement of electric charges. Such charges are present in all matter in a more or less quiescent state, and in some materials—the conductors of electricity —it is a comparatively simple matter to displace them; when this occurs an electric current is said to flow in the material.

Some idea of electric currents may be obtained by comparison with the power transmission system of a bicycle with a fixed wheel. In this we have a chain sprocket with pedals attached, a back wheel with a chain sprocket, and an endless chain running over both sprockets. Imagine the bicycle to be on a stand, so that it is possible to follow the movements of the sprockets and the chain. As it is a fixed-wheel machine, the back wheel will follow both forward and backward movements of the pedals.

We will let the sprocket on the back wheel represent an electric lamp and any movement of it indicate that it is illuminated; the brightness of the lamp may be proportional to the rapidity of movement. The pedal sprocket can be the machine in the power-house which supplies the current, and the links of the chain may represent electric charges.

With the pedals stationary there are stationary charges in the lamp represented by the links round the back sprocket, in the cables by the two sets of links between this and the pedal sprocket, and in the machine by the links round the pedal sprocket.

Let us first consider d.c. (direct current) supply. The machine in this case is the generator, which, on being set in motion, pulls one of the charges from the top cable. This is at once replaced by another, and so on all the way along the cable to its termination at the lamp. The cable pulls one from the lamp; this pulls one from the bottom cable, and this, in turn, pulls a charge from the generator. The charges are in motion, an electric current is flowing, and (as the back wheel of the bicycle indicates) the lamp lights.

The links in the bicycle chain are behaving as the charges in our electric system do, imparting motion to the back wheel in one case and illuminating the lamp in the other, a steady taking and giving up of links or attraction and repulsion of charges.

It will be realised that the links in the top half of the chain are moving in the opposite direction to those in the bottom half; the same applies to the charges in the two direct current cables, where in one the electric charges are being given up to the generator and in the other are being taken from it. The former is said to have positive polarity and the latter negative. Polarity is relative; to say that a cable or anything else has a positive polarity means that it is positive with respect to some other object, which must therefore be negative with respect to the first.

In direct current supply, then, there exists a continuous and uni-directional stream of electric charges travelling round in a circuit of generator, cable, lamp, cable, and back to the generator. The brightness of the lamp depends upon the number of charges of electricity which pass through it in a given time, so that to obtain a steady light, or to maintain a steady speed on the bicycle, the generator or the pedals must be turned at a constant rate. If this be increased, then the lamp will brighten; similarly, if it is reduced, then our lamp is dimmed.

Alternating current (a.c.) is not quite so easy to illustrate, but our bicycle analogy may still be used. We must bear in mind, however, that any movement of the wheel indicates the fact that our lamp is alight, irrespective of the direction of movement. For instance, in the previous illustration of d.c. the pedals could equally well have been turned backwards. The back wheel would have turned just the same, the only difference being that the positive cable would have been represented by the bottom part of the chain instead of the top, or, in other words, the polarity of the cables would have been reversed.

For this illustration the pedal sprocket of the bicycle will not represent a

generator which is continually giving up and taking in electric charges. It represents, instead, an alternator which at one moment is pulling charges from the top cable and pushing them into the bottom, and at the next is pulling them from the bottom and pushing them into the top. Imagine the pedals of the bicycle to be moved half a turn forward and then half a turn backward; the back wheel will follow suit, and if the charges in our cables did the same thing the lamp would light, an electric current being a *movement* of electric charges. Two very important points must be realised here. The first is that after the pedals have been moved forward they must stop before they can be moved backwards. The links must stop moving and the back wheel must stop. It is the same with the charges in alternating current; they stop before changing direction, and as a result there is a momentary cessation of current—the lamp goes out. Secondly, since the pedals stop at each reversal they cannot possibly be moving at a constant speed; this is always either increasing from a stop or decreasing to a stop, and will be the highest between the two, whatever the direction.

In an alternating current this is precisely what happens to the electric charges; they surge first in one direction and then in the other along the cables, so that no permanent polarity can be ascribed to them. At one moment the top cable is positive with respect to the bottom, and at the next it is negative.

The alternator pushes and pulls at the charges in the cables and the lamp, forwards-backwards-forwards-backwards, and the brightness of the lamp follows their movement. At first the charges are stationary, then a few start to move forward, the number increases then diminishes, and the flow comes to a stop. The lamp is out, glows, brightens, dims, and is extinguished; then the charges commence their movement in the opposite direction, and once again the lamp brightens, dims, and goes out.

In order to produce the illusion of steady light this "cyclic" variation must be made to occur at a rate beyond that detectable by the eye. In this country the rate of alternation is maintained at fifty per second, in the United States at sixty per second, and the current is described as being a fifty or sixty cycle alternating current (written 50 ~ a.c. or 60 ~ a.c.). A cycle is one complete change in direction of flow, forwards and back again, during which the lamp is extinguished twice.

An alternating current, therefore, is one in which the direction of flow of electric charges in the circuit is continuously and rhythmically changing, and although fifty or sixty cycles per second is specified for mains supply systems, electric currents may be made to alternate from less than one cycle per second to tens and hundreds of millions of times per second. It is these latter which give rise to electro-magnetic or wireless waves, and in which we are interested from the therapeutic point of view.

Summarising to this point. We are now acquainted with the following facts: that an electric current is due to the movement of electric charges; that in direct current, this movement is a continuous one and is uni-directional; that in alternating current, the movement is oscillatory, with the result that

there are instants at which no current flows at all, and others at which the current is maximum in one direction or the other.

The two forms of current may be illustrated graphically, as in Figs. 1 and 2. It will be seen by Fig. 1 that one cable is always positive and the other negative, but in Fig. 2 at the commencement, both cables are at zero polarity; then, as cable one becomes positive, cable two becomes equally negative, until

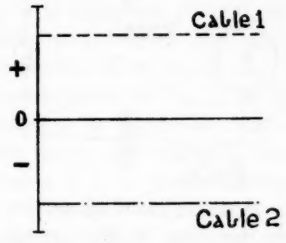

FIG. 1.

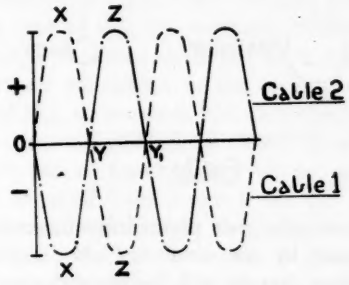

FIG. 2.

at the point X they reach their maxima, then gradually they become less positive and negative, until at point Y they are at zero again. From here the respective polarities are reversed, reaching second maxima at Z and decreasing again to zero at Y_1. This is one complete cycle, and in the British supply systems takes place in one-fiftieth of a second. The graph shows two complete cycles, and may equally well represent alternations of one million per second, in which case the time taken for one cycle would be one-millionth of a second.

The word " frequency " suggests itself here as describing the cyclic variation with time, and we say that the power mains have a " frequency " of fifty cycles per second, or that a radio station is operating at a frequency of one million cycles per second. In the latter case we use the prefix " mega " as signifying one million, and refer to the frequency as being one megacycle, omitting the " per second " as understood. This is written as 1 m/c., and is equivalent to 1,000 k/cs., or kilocycles, the prefix " kilo " meaning one thousand.

The fact that in alternating currents the electric charges do not actually circulate, as they do in direct current, endows them with certain peculiar properties. For instance, if we removed our lamp from the cables of the 50 cycle supply and interposed two large metal plates between each cable end and each lamp connection, and inserted between each pair of plates a glass plate of similar dimensions, Fig. 3a, we should find that the lamp would still light. Such an arrangement of plates is known as a condenser.

Also, if we replaced each pair of metal plates with a coil of many turns of copper wire, and the glass plates with iron wire which passed through both coils, our lamp would still light (Fig. 4). Such an arrangement of coils is known as a transformer.

If now the frequency of the alternating current applied to these devices is increased we find that we are able to reduce the area of the plates in the condensers and the amount of iron in the transformer without impairing the brilliance of the lamp. By increasing the frequency still further we are able

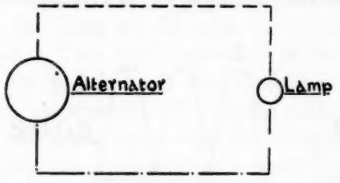

FIG.3a.

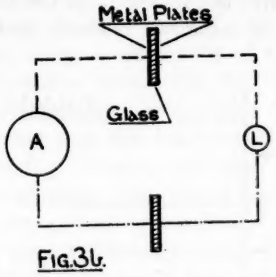

FIG.3b.

to remove the glass plates from the condenser so that the metal plates are only separated by air, and can also dispense with the iron in the transformer altogether, besides still further reducing the area of the plates and the number of turns of copper wire in the coils.

Eventually, we arrive at frequencies at which we are able to light our lamp by attaching it to a single loop of wire and placing it between the plates of the condenser, or the few turns of wire which is all that now remains of the transformer (Figs. 5 and 6).

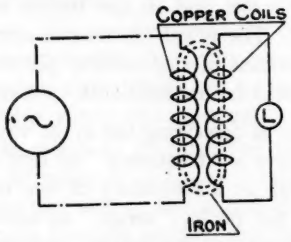

FIG.4.

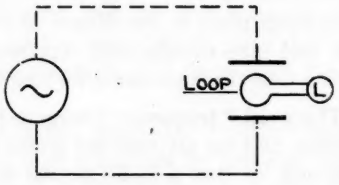

FIG.5.

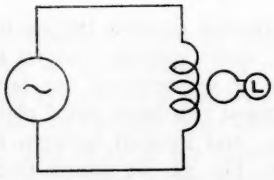

FIG.6.

Beyond certain frequencies early in the kilocycle range it becomes impossible to use an alternator, which is now replaced by an apparatus known as a power oscillator. Details of such an apparatus are outside the scope of this article, as are the technical explanations of the above phenomena; suffice it to

explain that by means of an arrangement of valves, coils and condensers the apparatus is capable of generating alternating or oscillating currents of very high frequency. From now on we shall use the terms " oscillator " and " oscillatory currents " in preference to " alternator " and " alternating currents."

In oscillating currents it will be realised that the electric charges themselves do not circulate through the oscillator, the cables, and the lamp, as they do in d.c.; their movement is restricted to oscillations about their original point of rest. It is apparent, though, by Figs. 5 and 6, that this oscillatory movement is able to influence the electric charges in other materials at a distance. Furthermore, if we move our lamp and its coil about in the vicinity of the condenser plates of Fig. 5, or the coil of Fig. 6, we shall find that this sphere of influence is limited in range and to certain orientations of the lamp with respect to it. By changing the lamp to one of lower power we are able to illuminate it at a greater distance, but we shall burn it out if we put it too close. This shows that energy, which is required to light the lamp, is being radiated from the condenser plates and the coil, that the energy is greatest at certain points in close proximity to them and decreases at a distance, and that

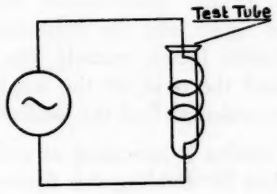

FIG. 7.

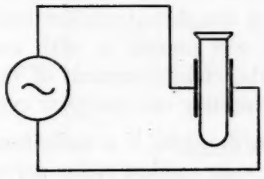

FIG. 8.

there is a well-defined area, or " field," of energy within which it can be demonstrated.

If we had two lamps, each with a loop of wire, and found by experiment two points in the energy field where they were each illuminated to the same degree of brilliance, we should find that on moving one of the lamps closer to the source of radiation (the condenser plates or the coil) it would absorb more energy and become brighter; the second lamp, however, would become proportionally less bright. This demonstrates that the amount of radiated energy is limited, and that its absorption at one point in the field must be at the expense of the remainder.

So far we have used lamps as being a convenient form of visual demonstration, but as we now approach the explanation of the technique of short wave therapy it becomes desirable to demonstrate the effects of this radiated energy on materials other than metals.

If a test-tube containing egg albumin be inserted into the coil connected to our oscillator, and left there for a while, the albumin will coagulate with the heat caused by the rapid oscillation of its own electric charges under the influence

of the energy field of the coil. The same thing will happen if the tube is placed between the plates of the condenser (Figs. 7 and 8).

This experiment may be continued with other test-tubes containing various liquids. If in each case the temperature is checked before being put into the coil, and again after removal, different rises of temperature will be found in each specimen for the same duration of irradiation, the increases being relative to the electrical conductivity of the liquid concerned. That this heating is due solely to the effects of the energy field, and not to heat conducted from the coil or the plates of the condenser, may be proved by checking their temperatures before and after each test. They will be found to be unaffected, unless the specimen has been heated to such a degree that heat has been conducted to the coil or the plates from it.

From here to therapeutic application is a short step. It remains, first, to explain where the short waves enter into it.

Since, as has been shown, an electric current is a movement of electric charges, we may well inquire as to what speed they move. Electricity and its associated phenomena have been found to travel at the speed of light, namely, 186,000 miles per second, or, more conveniently, 300,000,000 metres per second. A simple calculation involving this figure and the frequency of the oscillation will present us with another valuable factor, namely, the distance between the commencement of one cycle and the next, or the length of the wave representing one complete cycle, the " wavelength " of the oscillations.

As an example, if a radio-transmitting station is operating at a frequency of 1 m/c. (one million cycles per second), then by dividing this figure into the velocity (three hundred million metres per second) we shall get as a result the number of metres for each cycle; this is the wavelength, and in this example would be 300 metres. Similarly, a frequency of 3 m/cs. is equivalent to a wavelength of 100 metres, and a wavelength of 10 metres would be the same as a frequency of 30 m/cs.

The wavelength most commonly used for therapy is 6 metres, which corresponds to a frequency of 50 m/cs. The range of these " radio frequency " oscillations is divided arbitrarily into bands, which are known as very low, low, medium, high, very high, ultra-high, and super-high frequencies. In a similar manner, the wavelengths are divided into very long, long, medium, short, very short, ultra-short, and micro-waves. The 6 metre wavelength actually comes into the category of very short waves, but there seems to be a disinclination to change the title since the divisions were re-classified for the convenient inclusion of micro-waves. Certain Radar equipments use frequencies of ten thousand million cycles per second (10,000 m/cs.), a wavelength of 3 centimetres, and experiments are being conducted in the U.S.A. and in this country to determine the value of such oscillatory currents in treatment.

Following upon the experiments described above, it is not difficult to realise that biological material can be heated in the same manner. Metal plates may be placed in such a way that the tissues are enclosed within their field of energy,

or a coil of flexible wire may be wound around a limb so that it gets the full benefit of the energy field of the coil, and, in fact, this is what is done.

Heating by this method has one very big advantage over heating by conduction from a poultice or a hot-water bottle, or other similar means. The whole mass of tissues is subjected to the effects of the field of energy instantaneously, inside as well as out. The bone marrow, the musculature and the superficial tissues are all influenced immediately; the heat generated in them is modified, of course, by the circulation.

Holzer and Weissenberg, in their book on short wave therapy, confirm that short waves inhibit vaso-constriction by their direct action on the sympathetic nervous system; this occurs at intensities below those required for the production of direct heating. The hyperæmia which results lasts for some hours after irradiation of the tissues. It is not an unusual occurrence for individuals who have at some time suffered from neuritis to experience, when

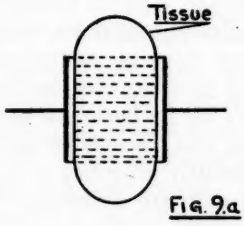

Fig. 9a

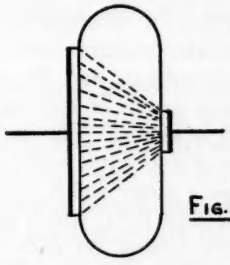
Fig. 9b

in the vicinity of short wave equipment, an unpleasant tingling sensation in the nerve fibres that were previously affected, and this fact lends support to the previous statement.

Short wave therapy is therefore indicated for the treatment of conditions where the blood supply is inadequate for rapid recovery, or where a local hyperæmia would be beneficial and local heating assist.

For treatment purposes, various sizes of metal plates are used. These are flexible and enclosed in rubber envelopes; they are spaced from the tissues by means of thick, perforated felt pads and are used in pairs of the same size or of different sizes, according to the site of the tissues to be treated and the locality of the maximum energy concentration required. Fig. 9 illustrates what is meant by this. In 9(a) the plates, or electrodes, as they are called, are of the same size and are at equal spacing from the tissues. In this case the energy will be distributed through the whole mass, as indicated by the dotted lines. In 9(b), however, one electrode is of greater area than the other, and, as seen by the dotted lines, the energy becomes more concentrated at the smaller electrode. so that the tissues immediately underlying the latter will be more influenced than the others.

By using different combinations of electrode size and relative spacing it becomes possible to direct the energy to a certain extent. Fig. 9c shows how the electrodes may be used on a common surface, the dotted lines again indicating the energy field between them.

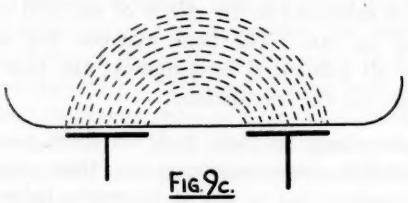

FIG. 9c.

It is sometimes necessary to give treatment in situations where the use of the pad electrodes is either impossible or inconvenient, such as to the limbs of a greyhound. In such cases we may employ the coil mentioned previously, and for this purpose a flexible, insulated cable is wound loosely round the limb.

The oscillator which is used must have sufficient output for fairly intense heating of the subject, and the energy delivered must be controllable; there should be some means of indicating this and of checking that oscillations are actually being generated. The equipment which I use for horses has a maximum output power of 250 watts, while my smaller dog unit has only 60 watts. Both machines have a meter which indicates approximately according to the output power, and a pilot light, which shows that the units are oscillating; there is a single intensity control on each.

Treatment is given for fifteen or twenty minutes per session, the number of sessions depending upon the condition being treated. Where time is an all-important element, as it invariably is with racehorses and greyhounds, I have found it advisable and beneficial to give three treatments a day, thus maintaining the hyperæmia for a period exceeding twelve hours continuously.

The intensity of the treatment also depends on the condition; in chronic cases it is not unusual to find that the animal will tolerate a very high intensity without discomfort, and that its sensitivity increases after three or four treatments, so that the intensity has to be lowered. It is of the utmost importance that the animal experiences no discomfort; it should only be aware of a gentle sensation of warmth in the tissues under treatment. This is a matter of experience on the part of the operator, but indications, such as pawing or raising the limb, or attempting to get rid of the electrodes, calls for immediate lowering of the intensity. The production of a profuse sweat in the region under treatment need not be viewed with alarm, but sweatings between the pads in a dog definitely indicates too high an intensity.

I have come across very few animals, horses or dogs, which object to this form of treatment. Many of them get drowsy, as do some human beings, while treatment is in progress. Where there is any pain, relief is almost immediate.

THE CONTROL AND PREVENTION OF INFECTIOUS DISEASE IN THE HATCHERY

By J. E. WILSON,

Ministry of Agriculture and Fisheries, Veterinary Laboratory, Eskgrove, Lasswade.

SERIOUS and widespread losses may arise from infections originating in the incubator and the risk of acquisition, propagation and dissemination is proportionately greater in large establishments drawing supplies of hatching eggs from many sources.

The commonest diseases in this group are bacillary white diarrhœa, salmonellosis and omphalitis or navel ill.

In bacillary white diarrhœa the disease is introduced into the incubator by the hatching of one or more eggs infected with *S. pullorum;* the organism is present in the ovary of the carrier hen and transmission is direct. There is a rapid spread by inhalation during the process of drying off in the incubator and further spread occurs in the brooder from the ingestion of food and water contaminated with infected discharges.

Whereas within recent years many outbreaks of salmonellosis in chicks have been attributed to other members of the salmonella group of organisms new to this country but present in spray-dried eggs, during 1948 and even more so in 1949, most of the outbreaks have been associated with *S. typhi-murium* with *S. thompson* a poor second. The chief method of introduction of infection into the incubator is the setting of eggs, several of which may have the outside of the shell contaminated by the organism, acquired through contact with infected fæces during passage through the cloaca at the time of laying. Penetration of the shell takes place early in incubation. If a massive infection with an organism of high virulence is present the embryo may die, but usually a proportion of infected eggs hatch and the subsequent spread of the disease is the same as in bacillary white diarrhœa. Direct egg transmission may occur in the duck; there is no scientific evidence that it ever occurs in the hen, but there is strong circumstantial evidence that it may occasionally take place. This aspect will be discussed later in the paper.

In omphalitis, sometimes called mushy chick disease or navel ill, coliform organisms and staphylococci are chiefly implicated. Faulty incubation may be a predisposing factor and although the disease does occur in well-run establishments, it is more common where conditions are less strict. The most serious outbreaks generally take place towards the end of the hatching season as a result of accumulation of infection.

Control Measures

In bacillary white diarrhœa the chief measure of control is the careful application of the agglutination test with the object of eliminating the possibility

of introduction of disease by the setting of infected eggs, the commonest and the most dangerous method of acquiring infection.

Hygienic measures to prevent the introduction of disease by other means are of importance, but must be considered as secondary to the former.

In salmonellosis, on the other hand, hygienic measures are of primary importance; indeed, the disease may generally be controlled and prevented by this means alone, and recourse to the agglutination test is seldom necessary.

Vermin control should be practised continually and food should be stored in rat- and mouse-proof containers. It must be remembered that, apart from representing a possible primary source of introduction of the disease, rats and mice may themselves acquire infection from diseased chicks and thus assist further spread. Fly control should also be instituted, particularly in the brooder house and food store.

Ample nest accommodation should be provided in the laying houses and the nest linings should be replaced frequently. Badly soiled eggs should not be retained for hatching; if, for any reason, this is unavoidable they should be soaked in 5 per cent Dettol solution at a temperature slightly higher than that of the eggs and the fæces removed by swabbing. During the period of storage, which should always be as short as possible, eggs should be kept in a cool room.

Incubator fumigation using formaldehyde gas is probably the most important single factor in prevention and this should be done as soon as possible after the machine is loaded. The actual time will depend on the amount of formaldehyde to be used. As it is customary for a fresh batch of eggs (one-third of the total capacity) to be added each week to replace those transferred to the hatching compartment, fumigation of the incubating chamber should be repeated each time this is done.

There is a wide variation in the amounts of the reagents recommended for fumigation. Formerly 35 c.c. of formaldehyde was added to 17.5 grams of potassium permanganate for every 100 cubic feet of incubator space, but it is now more usual to use as much as 150 c.c. formaldehyde and 100 grams of potassium permanganate. It may be a sound policy to use the higher concentration following an actual outbreak and the smaller amounts as a routine precautionary measure.

Infection is cumulative and in addition, the virulence of the organism is enhanced by passage. Thus, it is frequently only after the second or third hatch that an explosive outbreak occurs. This may explain the good results obtained by the use of the lower concentration of formaldehyde resulting in a fumigation, not necessarily lethal to the organism, yet strong enough to reduce its vitality sufficiently to prevent penetration. If this does not occur there is little likelihood of the disease being acquired from the outside of the shell as the environmental conditions are inimical to the organism; moreover, it is subjected to a second and third fumigation on the eighth and fifteenth days respectively. Experimental work may have been misleading as the isolation of a living

salmonella after experimental fumigation does not necessarily imply that an outbreak of the disease would have resulted for the reasons already stated, and in addition it is probable that the natural defences of the chick can deal adequately with moderate infection.

The humidity of the air in the incubator affects the germicidal effectiveness of the formaldehyde. It is important, therefore, if the small quantities are used, to ensure that humidity is about 68 per cent (wet bulb 90 deg. and dry bulb 100 deg. F.), so that the maximum effects may be obtained. A suitable time for fumigation is about 6-8 hours after the eggs are set.

When the larger amounts are used the humidity is unimportant as the concentration of gas obtained is lethal for salmonella after 30 minutes' exposure in a dry atmosphere at room temperature. Eggs may therefore be fumigated immediately after setting; there is no need to wait for the incubator temperature to return to normal.

Eggs may also be fumigated daily after collection by placing them in a cupboard, disused incubator or similar container. There does not seem to be much benefit from this procedure as under ordinary conditions of storage penetration is unlikely to occur. Infected chick boxes, utensils, clothing and other equipment can, however, be effectively dealt with by this method. It is also a good practice to fumigate the hatching compartment before removing the debris remaining after the hatch is taken off, to prevent spread of contaminated down and fluff throughout the incubator room.

There is no danger to the embryo at any time during incubation except between the 24th and 96th hours. There is no need, however, to fumigate during this critical period of maximum embryonic susceptibility as, to be effective in preventing shell penetration, the operation should have been completed before this time is reached. As an additional safeguard the fumigant may be neutralised by introducing into the machine a volume of 25 per cent ammonium hydroxide equal to one-half the volume of formalin used, either by soaking a cheese cloth or by sprinkling on the floor.

Experience has shown that the majority of outbreaks can be controlled by the methods described, but except in an outbreak at the very outset of the hatching season, by the time a diagnosis is obtained, at least two-thirds of the eggs in the incubator will be at a stage of development when fumigation is valueless.

If the outbreak has been severe and generalised throughout the hatch it may be considered desirable to dispose of all the remaining eggs. In some cases a study of the hatchability figures and the mortality rate may point to a particular batch as a source of infection and it may be sufficient to remove eggs from this supplier. Where this is not possible, it should be borne in mind that eggs from pullets are a more likely source than those from hens, as with increasing age "carriers" tend to cease eliminating the causative organism. It may be possible to segregate such eggs and hatch them in a separate machine.

It has been found that the disease persists on certain farms even after early fumigation of hatching eggs, and it has been considered that this was due to the use of insufficient formaldehyde or to faulty technique or to inadequate penetration of the gas to the more inaccessible parts of the machine. A more likely explanation is that direct egg transmission was taking place. This certainly occurs in the duck and as it is not disputed that *S. typhi-murium* can be isolated from the ovary of certain hen carriers, it is arguable that the organism may occasionally be present in the egg, although it has never been definitely isolated from the new-laid hen's egg. In dealing with persisting outbreaks, agglutination tests of the suspected flock have been carried out and in every case carriers have been demonstrated in a proportion of which the organism has been present in the ovary. After the removal of these birds the measures described above have proved effective in the prevention of further outbreaks.

It is recognised that the agglutination test is unsatisfactory as the sole method of prevention as birds excreting the organism in the fæces may not react, but early fumigation of eggs controls this type of infection; a combined programme of testing and fumigation is therefore essential in flocks where the latter method alone has proved ineffectual.

The desirability of fumigating the hatching compartment as soon as chicks have been removed, before further cleaning, has already been noted, otherwise the large amount of dust and fluff which is inevitably broadcast throughout the incubator room, is a potential source of spread of the disease, should infection be present. It may also be a safeguard to personnel, although the gross contamination present in infected premises to which workers are subjected apparently without ill-effect is such that it seems probable that the organism, which in its passage through chicks becomes increasingly pathogenic for that species, tends to lose its virulence for human beings.

An apparatus of the phantomyser type is also useful in the hatching room and packing rooms, reducing aerial contamination without inconveniencing workers in any way.

Omphalitis is readily controlled by fumigation of the incubator and strict attention to the hygiene of the incubator room.

Members of the salmonella and coliform groups of organisms are destroyed by the usual disinfectants. *S. typi-murium* appears to be slightly more resistant than *S. pullorum* or *B. coli*. Chloros, Deosan and Dettol in the recommended strengths have all given good results. Soapy water and washing soda have relatively little germicidal effect, however, unless the period of exposure is abnormally long, but are valuable as cleansing agents prior to actual disinfection.

No attempt has been made to describe the general methods of hatchery hygiene and other precautions which supplement them, but it is hoped that this short description of methods which have proved successful under practical conditions for the control of salmonellosis may be of value to veterinary practitioners and others who may be called upon to advise on the problem.

THE ANNUAL GENERAL MEETING OF THE DANISH VETERINARY ASSOCIATION

THE Annual General Meeting of the Danish Veterinary Association was held at the Royal Veterinary and Agricultural College of Copenhagen on Sunday, September 25, in connection with the celebration of the Association's centenary.

The large lecture room in which the meeting took place had been beautifully decorated with flowers and flags, provided by the management of the College in honour of the day.

On account of the special occasion, the attendance at the meeting was unusually great, numbering altogether some 300 persons; among these were many guests from the Scandinavian countries, besides two from Britain.

The President, Dr. N. Plum, opening the meeting, addressed a warm welcome to members and guests, and a particular welcome to the two British representatives, Professor T. Dalling, Chief Veterinary Officer, Weybridge, and Professor W. M. Mitchell, Edinburgh, as well as to the many representatives from the Scandinavian countries.

At the President's proposal, it was decided to send a telegram of homage to the King.* Later in the day a telegram of thanks was received from His Majesty.

Under the first item of the agenda, the President moved that Dr. Axel Thomsen should take the chair during the meeting; the motion was passed unanimously.

The Chairman called upon Dr. Plum to read the President's Report.

The President first referred to the deaths of members since the last meeting, and said a few words in their commemoration; the assembly demonstrated its sympathy by rising.

Next, the President announced that Mr. S. O. Koch, Chief Municipal Veterinary Officer of Aarhus, had been elected President for the next period of three years.† The President congratulated Mr. Koch on his election.

The remaining part of the meeting was devoted to ordinary business, except for the last item of the agenda, under which the election of ten Honorary Members of the Association was announced.

THE CENTENARY

As we all know, this year's Annual General Meeting was combined with a series of festivals on the occasion of the centenary of the Danish Veterinary Association.

*This way of declaring one's loyalty to the Monarch became customary in Denmark during the German occupation.

†The President, as the two other members of the Central Board, is elected by ballot among four candidates nominated by a committee of representatives from all divisions of the Association. The president can be re-nominated once by simple majority, and a second time by a qualified majority. The retiring President, Dr. Plum, had been in office for three periods, i.e., nine years.

The Central Board—the Secretary not to be forgotten—had gone to great pains in order that this jubilee might be kept up in a worthy manner, in private as in public.

And their efforts were crowned with success!

It began on Saturday evening, September 24, in the Royal Theatre—or, indeed, probably at the entrance to the theatre, where several hundred veterinarians arrived with their ladies.

In the dress circle and the stalls all seats were soon occupied by spectators in full evening dress, among whom were all our guests from home and abroad. It was observed that everybody in the theatre seemed to greet everybody else —waving and smiling; there were friends and old fellow-students everywhere in the large, beautiful auditorium, so filled with festivity. So, when the conductor of the orchestra, John Frandsen, raised the baton, he had behind him a very receptive audience in a festival mood, created by that rare occasion—the 100th anniversary of our Association.

First, there was given the amusing one-act ballet, " Cupid's and the Ballet-Master's Caprices," and then, after the interval, the beautiful, romantic two-act ballet, " Giselle."

The first ballet was amusing: with " Giselle," however, people were completely enraptured. Our magnificent *prima ballerina,* Margot Lander, and Bφrge Ralov, were dancing—so it seemed—more fascinatingly than ever before. Whenever, in their performance, they achieved the really great things, one had a feeling of unbounded delight—and therewith, I think, the aim of the dance was fulfilled.

However, the other dancers are not to be neglected; once again they showed that the Royal Danish Ballet is of very high standard. The evening was a great experience—which opinion was also voiced by the foreign guests.

Thus, it turned out to be a really good idea to initiate the celebration of the centenary by meeting to see the plays in our Royal Theatre, which is so rich in tradition, and which certainly all of us love.

After the theatre, many members and guests gathered in smaller parties at various restaurants, or in private houses; these meetings contributed greatly to the renewing of old friendships and acquaintances.

At the General Meeting, next morning at the College, the official proclamation of Honorary Members took place.

Those proclaimed were:—

Foreigners.—Professor T. Dalling, Chief Veterinary Officer (London); Professor W. M. Mitchell, Principal of the Royal (Dick) Veterinary College (Edinburgh); Dr. R. Stenius, Veterinary Councillor of State (Helsinki); Mr. A. Backmann, Veterinary Councillor of State (Malm, Finland); Mr. S. Hlidar, Chief Veterinary Officer (Reykjavik); Professor A. Brandt, Principal of the Norwegian Veterinary College (Oslo); Professor Dr. K. Eriksson, Principal of the Swedish Veterinary College (Stockholm).

Danish.—Professor P. Grunth (Copenhagen); Mr. H. C. Niendahl, Veterinary Inspector (Kolding); Mr. A. Svendsen, Chief Veterinary Surgeon (Odder).

Addressing a few words to each in particular, Dr. Plum, visibly moved, handed the new Honorary Members their certificates, which were written in calligraphy and enclosed in decorative covers. The audience, standing, applauded vigorously. Actually, Dr. Plum made ten short speeches—and ten very good ones, although the task was very difficult. Perhaps these speeches represent the President's finest oratorical achievement during his nine years of office; unfortunately, no manuscripts are available.

The thanks of the new Honorary Members for the distinction conferred upon them were voiced by Professor Mitchell (on behalf of Professor Dalling and himself), Dr. Stenius (on behalf of Mr. Backmann and himself), Mr. Hlidar, Professor Brandt, Professor Eriksson, and Prôfessor Grunth (on behalf of Mr. Niendahl, Mr. Svendsen, and himself).

The large, beautiful lecture room in which the meeting took place had been nicely decorated with flowers and other presents, sent in honour of the centenary. Among the senders were the Danish Medical Association, the Danish Association of Chemists, the Danish Association of Dentists, the Joint Organisation of Danish Dairy Associations, and the Joint Organisation of Cattle-Breeding Associations. Further, flowers had been sent from a number of sectional veterinary associations, as well as from private persons.

Because of the occasion, also the Memorial Fund* of the Danish Veterinary Association was remembered. From sectional associations, and other institutions, gifts of money were received, amounting to a total of about 100 Lst.

Finally, telegrams of congratulation were received from a number of associations, institutions and private persons.

H.M. the King wired from " Fredensborg," his summer residence: " With congratulations on the centenary, I send my sincere thanks for the kind regards."

When, on the following day, Dr. Plum was received by the King (to thank him for an Order he had received) His Majesty repeated his good wishes for the Association.

The mornnig ceremonies were concluded by personal presentations of gifts and addresses of homage.

On behalf of the Finnish Veterinary Association, Mr. Backmann presented a very beautiful chairman's mallet (" klubba "), made of a special Finnish wood (masur) and mounted with silver. On handing over the mallet, Mr. Backmann made a short speech, in which he expressed the devotion and respect of the Finnish veterinarians towards their Danish colleagues. Impulsively, the President immediately found reason to make use of the mallet in his strong hand. To the surprise of everybody, the mallet stood the trial; the counter, however, received a mark! !

* Founded in memory of the colleagues who gave their lives in the fight against the German invaders.

Already on the real day of the centenary (February 8)* a beautiful written address of homage had been received from the Finnish sister association. It read as follows:—

"On the occasion of the 100th anniversary of the Danish Veterinary Association, on February 8, 1949, the Finnish Veterinary Association wants to present its most sincere and respectful congratulations.

"We bear in our minds the magnificent kindness and loyal colleagueship which have for a long time been extended from the Danish Veterinary Association to the veterinary profession of Finland and to our Association, as well as the most valuable material aid that we have received in times of austerity and hardship.

"The Finnish Veterinary Association has always felt the greatest respect for the Danish Veterinary Association, and admiringly followed the progress it has achieved in the advancement of the Danish veterinary profession.

"The Danish Veterinary Association is the oldest of the Scandinavian veterinary associations, and by its pioneer work the other veterinary associations in Scandinavia have been inspired to ardent work within their respective fields.

"On this festival day, the Finnish Veterinary Association also brings its humble thanks for the years that have passed, and best wishes for continued success in the important work for Denmark and the Danish veterinary profession which is being done by the Danish Veterinary Association.

The Finnish Veterinary Association.

R. STENIUS, President.

KLAUS TARNAALA, Secretary."

Afterwards, Mr. H. Lund-Larsen, on behalf of the Norwegian Veterinary Association, and Mr. J. F. Wilhelmson, on behalf of the Swedish Veterinary Association, each presented, and read aloud, a splendid written address of homage.

The Norwegian address read as follows:—

"*The Centenary of the Danish Veterinary Association.*

"On the occasion of the centenary of the Danish Veterinary Association, the Norwegian Veterinary Association presents its warmest and most sincere congratulations. Our organisations are mutually attached by strong bonds, and we have always felt the need of strengthening and further developing these bonds. We wish the Danish Veterinary Association success in its endeavours to raise the position and add to the prestige of the veterinary profession, and we join in the old prayer, *Quod bonum felix faustumque sit!*

Oslo, in November, 1949.

The Norwegian Veterinary Association.

H. LUND-LARSEN, President."

* The celebration of the day was put off until the time of the Annual General Meeting, for practical reasons.

The Swedish address read:—

"*To the Danish Veterinary Association.*

"On its centenary, the Swedish Veterinary Association presents its warm congratulations, and its thanks for fruitful co-operation to the promotion of common cultural tasks.

F. WILHELMSON.
GUNNAR T. KRANTZ."

The President expressed, most heartily, thanks for the presents, and for the kind words that had been addressed to the Association in writing and in speech; and he asked the representatives of the donors to pass on the thanks to their respective associations.

After informal conversations during the luncheon interval, we assembled again in the lecture room to hear the lecture of the day. It was quite natural that on this particular occasion the Central Board had called upon our highly esteemed veterinary historian, Mr. Philip Hansen. In his usual elegant manner, and without any paper, Philip Hansen talked to the expectant audience on the subject, "The Danish Veterinary Surgeon," illustrating the conditions of the profession during past times. The lecture, which was received with much applause, will be published at a later date.

The closing function, and, indeed, the climax of the festivity, was the banquet held the same evening at "Wivex"—which is, in its reconstructed state after the fire, really an international restaurant.

The entrance to the restaurant, in Vesterbrogade, was besieged by onlookers as the cars drew up. They wanted to see the entrance of the people in full evening dress who were the cause of the restaurant being closed to the public on that day—which is a rare event.

Four hundred and twelve participants were assembled when, at 7 p.m., to the accompaniment of music, we went to the splendidly decorated tables in the magnificent room. Besides those already mentioned, the following foreign guests were present:—

From Sweden: Professor Dr. A. Hjärre; Professor Dr. B. Carlström; Mr. R. Larsson, Chief Municipal Veterinary Officer, of Stockholm; Mr. K. Hallgren, District Veterinary Officer, of Sollebrun.

From Finland: Dr. V. Rislakki, Director of the State Veterinary Laboratory, Helsinki; Mr. B. Osterholm, Deputy Chief Municipal Veterinary Officer, of Helsinki.

From Norway: Mr. H. P. Jensen, Chief Municipal Veterinary Officer (retired), of Haugesund.

Among the more prominent Danish guests were the Chief Veterinary Officer, Mr. G. Petersen, the Director of the Royal Veterinary and Agricultural College, Professor Thorkil-Jensen, and all the veterinary professors. Further, there were the former Director of the College, Professor Dr. C. H. Hansen, and the Director of the State Veterinary Serum Laboratory, Professor M. Christiansen.

The Ministry of Agriculture was represented by the Secretaries of State, Mr. J. C. Mogensen and Mr. P. Stahlschmidt, besides by Mr. V. Hornslet, Head of Office, and Mr. V. Brorson, Commissioner, and others.

The Danish Medical Association, the Danish Association of Dentists, and the Danish Association of Chemists were represented by their presidents, viz., Dr. C. Clemmesen, Mr. A. Riis-Petersen, and Mr. K. Borgen, respectively.

Several agricultural organisations were also represented. There were two representatives of the Joint Representation of Danish Milk Depots, viz., the chairman, Mr. J. Kyed, and the administrator, Mr. A. Pedersen. Further, the Organisation of Private Bacon Factories was represented by its chairman, Mr. H. Sørensen, and the Joint Co-operative Danish Bacon Factories by their director general, Mr. H. Behnke. Finally, the Joint Organisation of Cattle-Breeding Associations was represented by its chairman, Mr. J. Gylling Holm.

In a humorous speech, the President welcomed everybody, addressing specially the official guests from at home and abroad, not least the British representatives.

Once again, by inviting so many people, the President had wished to renew personal contacts, and stressed the importance of such contact—supposedly, in the first place, the contact with colleagues from our neighbour countries, for which he has been working so much throughout his years of office.

Before ending his speech of welcome, the President drew attention to the fact that at each cover there was an ash-tray, made by the Royal Copenhagen Porcelain Factory, and decorated with a picture of Aristotle. These ash-trays were meant as souvenirs for the participants—a noble gesture.

After dessert had been served, other speeches followed. First, Mr. J. C. Mogensen, Secretary of State, was called upon. Next, on behalf of Professor Mitchell and himself, Professor Dalling made a speech full of wit and humour, in which, among other things, he expressed his satisfaction with the great increase, during the last few years, of the interchange between the British and Danish veterinary professions. Thereafter, Dr. Stenius, speaking on behalf of all the Scandinavian guests, thanked the Association most heartily. Then the floor was given to the representative of Iceland, Mr. Hlidar, Chief Veterinary Officer, who, at the end of his speech, created a really first-class sensation; on behalf of the President of Iceland, Mr. Hlidar fastened the insignia of a Grand-Knight of the Order of the Falcon of Iceland round Dr. Plum's neck! (Earlier in the day the King had bestowed on Dr. Plum the Honorary Badge of the Men of Danebroge.) People applauded persistently, taking this extraordinary opportunity to show the retiring President how much they appreciated his many years' of eminent work for the Association.

After this rather out-of-the-ordinary intermezzo, the Director of the Royal Veterinary and Agricultural College, Professor Thorkil-Jensen, paid homage to the Association in a lyrical speech. This speech was followed by a speech by the Chief Veterinary Officer, Mr. G. Petersen, who cheered and thanked the Association.

After the toast of "The ladies"—humorously proposed by Professor P. Grunth—the President closed the enjoyable dinner at about 10 p.m.

Shortly afterwards—before people had finished their coffee—the dance began, and in spite of the heat of the late-summer night, it was energetically continued till after midnight. Not even during a light supper, which was provided by the Association, did it stop. Thus, it will be seen, all enjoyed themselves.

A colleague from the quiet heath of Jutland wrote to me after his return home . . . . "It must be said of Dr. Plum that he put a noble end to his presidentship; this festival formed a beautiful setting for what is, after all, the very best thing about such an occasion: the meeting with friends and acquaintances."

Many happy returns! AXEL THOMSEN.

CLINICAL ARTICLE

POISONING IN GOATS BY BLACK NIGHTSHADE (Solanum Nigrum)

By O. V. GUNNING, D.V.M., F.R.C.V.S.

IN August, 1943, I was called to a valuable herd of British Saanen goats, which had suddenly developed severe abdominal symptoms.

The symptoms found were various degrees of vomition, acute depression, and a reeling or staggering gait. I found a nine-year-old and two two-year-old goats affected. The oldest goat was vomiting ingesta in which plant leaves could be detected, and some form of plant poisoning was suspected.

Each affected goat was given ½ gr. apomorphine, hypodermically. This acted well on the old goat, which ejected large quantities of ingesta. On the remaining two goats it did not work so well, but, with the aid of a rubber tube in the œsophagus, I was able to stimulate some vomition in one.

After the results of the apomorphine had subsided the goats were each given chlorodyne, spirits of æther nitrosa, in linseed oil.

On the following morning, the two goats which showed the most severe symptoms were improving, but the one which was least affected was definitely worse. She was making marked heaving and neck movements, and after each effort she ejected a small quantity of vomit.

A further dose of apomorphine was given and the stomach tube passed, but as this excited the animal its use was discontinued.

On the following day, about 48 hours from the onset of symptoms, an urgent message was received to destroy the old goat, as she was sweating and in pain. It appeared that the bowels were not working. Persuading the owner to defer anything drastic, a full dose of magnesium sulphate was given, together with an enema.

On the fourth morning all the goats were chewing their cud, and from this time made an uninterrupted recovery. They were given small doses of bismuth pepsin co. twice daily.

On examining the pasture, considerable quantities of a weed were found, and it was obvious that it had been freshly eaten. A sample was forwarded to the Department of Animal Pathology, Cambridge, which confirmed the plant as black nightshade (*Solanum nigrum*).

H. C. Long states:

"Black nightshade (*Solanum nigrum L.*) contains the poisonous solanine, chiefly in the berries, but also in the leaves and stem. The percentage of the poison present varies considerably with soil and climate, so much so that some authorities appear to have held the plant to be innocuous, while others have noted its extremely poisonous character. For example, Cornevin states that Gohier gave 3 kilos (6½ lb.) in the green state to a horse, and found that it had no serious effects. Henslow states that children have been poisoned by the berries. It is stated in the *U.S. Farmers' Bulletin,* No. 86, that 'the more musky-coloured plants are the most poisonous. In some the amount of alkaloid in the ripe fruit and leaves is so small that these parts may be, and are, consumed in considerable quantity without any ill consequences. Poisoning does sometimes follow, but it is not clear whether this is due to improper preparation or to careless selection of the parts used. The use of black nightshade for food is certainly not to be recommended.' Cattle, calves, sheep, goats, pigs, ducks, and chickens have all suffered from poisoning by the plant."

The same author also quotes Ewart's remarks ("Weeds, Poison Plants, and Naturalised Aliens of Victoria," 1909) that this plant possesses no virulent poisonous properties, though it is commonly regarded as highly poisonous, partly owing to confusion with deadly nightshade and partly owing to hasty generalisation; that though a small amount of solanine is present in the stem and berries, these are usually less poisonous than green potatoes; that the berries are often eaten by children without any ill effects beyond, perhaps, a stomach ache, or, if eaten in excess, sickness and purging, and that the berries have even been used instead of raisins for plum pudding with no results out of the ordinary.

The fact remains, however, that the plant is untrustworthy, for it seems that the berries may be edible in some seasons, countries and localities, and poisonous in others, but any sample may be poisonous.

Perhaps these conflicting remarks explain the statement made by the owner that this particular weed had always been present in the pasture concerned, but this was the first occasion she had known the goats to touch it.

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REFERENCE

"Poisonous Plants on the Farm": H. C. Long, B.Sc.(Edin.).

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